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Insect-Proof Crops

The ideal way to repulse insect attack is by breeding resistant crop varieties. This approach usually involves no extra cost to farmers, leaves no residues, harms no pollinating insects, and does not upset nature's balance between insects and their natural enemies.

Over the past 40 years plant breeders and entomologists have made important progress in developing insect-resistant varieties of crops. For example, ARS scientists and their colleagues have bred 23 varieties of wheat that withstand the scourge of the hessian fly. Today these varieties thrive in 34 States with losses to this once formidable pest of only 1 percent.

More recently, scientists have turned to the task of imparting such resistance to vegetables. At present, 25 vegetables are reported to fend off 35 species of insects. These successes were achieved with a relatively modest research effort and scant knowledge about the nature of resistance and its inheritance in any of the vegetable crops.

Time and money go into developing resistant varieties. These expenditures will increase with the present ARS trend toward screening for insect resistance simultaneously with selection for disease resistance as well as yield and quality. It may take scientists working with such easily handled crops as tomatoes or wheat 10 years to find resistant germ plasm, incorporate its genes into commercially acceptable varieties, backcross the offspring with the parent stock several times to fix desirable qualities, and then propagate enough seed for commercial use. With such crops as alfalfa, selection alone sometimes gets the job done in 2 or 3 years. On reaching the goal, scientists cannot relax but must stay alert for new biological races of insects. Fortunately, these races require a few years to build up, giving scientists time to modify the heretofore resistant varieties.

Growers coping with a major insect problem obviously cannot wait 10 years for a remedy. Moreover, research resources are too often inadequate to carry out both immediate and long-range approaches. For long-range solutions, such as varietal resistance, the public must be willing to invest research dollars today in order to reap the application of research results 10 or more years hence.

We have scarcely begun to exploit the potential for varietal resistance. Resistant varieties are destined to play a bigger role in man's incessant war on insect pests, but it will take time.

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COVER: Wheat and other crops with inbred resistance to insects are the goal of intensive ARS plant breeding programs (PN–1924).

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Clifford M. Hardin, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Preparation of the purified glucose tolerance factor is tested by biologist Edward E. Roginski (PN–1923).

CHROMIUM PROMOTES HEALTH

A FREQUENT HEALTH HAZARD of old age is the body's failure to utilize carbohydrates efficiently. A possible solution for this may be found in chromium, one of the trace elements receiving increased attention in ARS laboratories.

Chromium is the active ingredient in a chemical substance that ARS biochemist Walter Mertz calls the "glucose tolerance factor" (GTF), a material required for efficient utilization of glucose. Chromium stimulates glucose metabolism.

In over half the elderly people studied in a previous investigation, the capacity to use glucose was impaired, sometimes quite severely, although not seriously enough to class the subjects as diabetic.

But, Dr. Mertz says, "productivity and the general quality of life are important. Any element deficiency that impairs attention, intelligence, or physical health detracts from this quality."

The human diet is believed to include two important categories of chromium: (1) the organic or GTF type, and (2) the "all other" inorganic category. The two differ in that most of the GTF is absorbed, compared with only a small percentage of the other types. Following absorption and transport, the GTF is probably stored in a "pool" before responding to glucose intake.

The "other" or inorganic types that are absorbed are transported to the various metabolism sites. In some individuals, one of these is the site of GTF synthesis. The inorganic chromium is synthesized into an active form and probably joins the storage pool for utilization when needed.

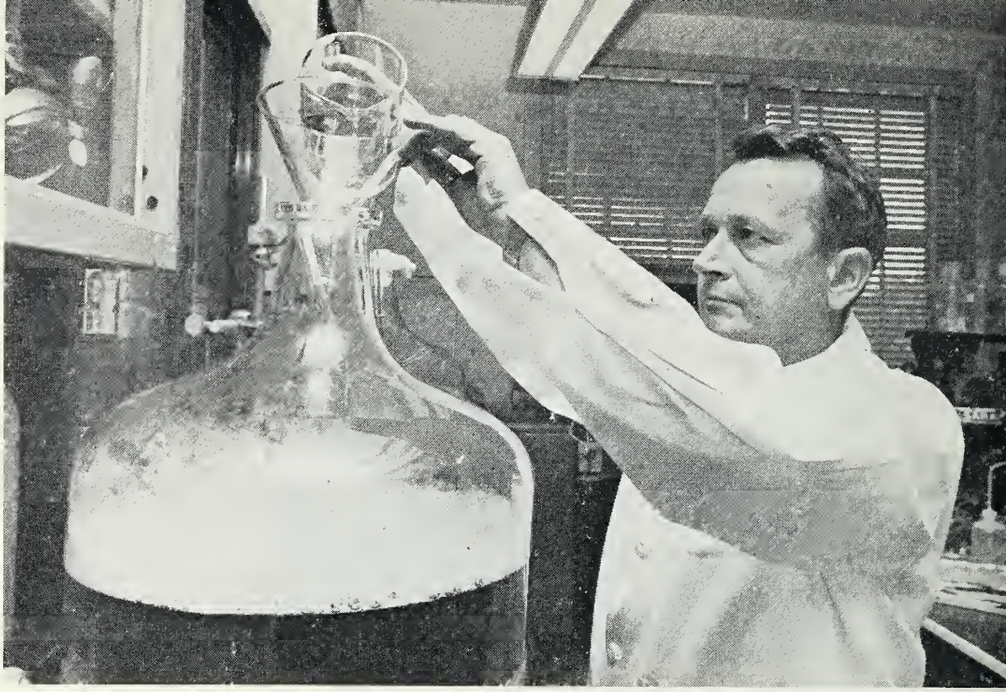
Current ARS studies indicate that the GTF chromium

is the physiological cofactor that assists insulin in easing the movement of glucose through the membrane into the cell. In normal persons, the chromium level in the blood is elevated in response to an intake of glucose, while in subjects with impaired glucose tolerance, the elevation does not take place.

In previous studies, Dr. Mertz found through blood tests that approximately half of a group of adult diabetics with impaired glucose tolerances improved slowly over a period of several weeks while receiving a chromium supplement. It is possible that the other half of the group tested did not respond to the supplement because they could not synthesize enough GTF. This, added to the fact that dietary GTF is also inadequate in many cases, is probably one of the reasons why the tissues of so many middle-aged and elderly people are low in chromium and that their glucose tolerance is impaired.

Chromium supplementation has restored normal carbohydrate utilization in some diabetics, middle-aged and elderly people, and malnourished children—but only where chromium deficiency existed. This signifies that low chromium states sometimes occur and, when present, are one of the causes of impaired glucose tolerance.

Dr. Mertz believes that a marginal chromium deficiency may exist in a considerable portion of the U.S. population. Thus, it would be desirable to conduct surveys to define the nutritional state of selected groups. Studies with GTF itself have not been carried out in man, and ARS scientists are now hoping to isolate large enough quantities to use with humans. ■



Top: *Before yeast cells are added to growing media, Dr. Mertz adds inorganic chromium to provide a culture of the GTF (870A714–19).*
Bottom: *Dr. Edward Toepfer runs samples of the culture through a liquid phase extractor to purify the GTF (870A715–25).*

Progress Report . . .

CHEMICAL SHEARING

Technician Dale Harper removes wool easily by rolling his wrist along the skin (ST–4033–9).

SINCE MAN first discovered wool, he has been shearing sheep—an ancient art that today requires scarce, highly skilled workers. But chemical defleecing, which requires little training, is close to replacing this art.

ARS scientists at Beltsville, Md., demonstrated the possibility of chemical shearing with cyclophosphamide (CPA) 2 years ago (AGR. RES., Oct. 1968, p. 8). Recent studies show no undesirable side effects of CPA on treated sheep, their wool, or their lambs. Its effect on the meat is still under investigation.

CPA works by constricting the wool fiber at the point of formation. As the wool grows, the constriction comes to the skin surface where the fibers can be removed.

A chemically defleeced sheep is virtually naked if defleeced 7 to 12 days after dosing and requires protection from severe weather. If the wool is left on the treated sheep too long, however, it may fall or be rubbed off. Further research may permit wool removal without loss after the 12th day so the sheep have a protective coat of new wool when defleeced about the 21st day after treatment.

Effects of chemical defleecing on the sheep were studied by geneticist Clair E. Terrill, biologist Ethel H. Dolnick and nutritionist Ivan L. Lindahl. Twenty sheep were given by stomach tube 24 milligrams of CPA per kilogram of body weight in mid-March and were defleeced 8 days later. No wool loss occurred before defleecing. The defleeced sheep were fitted with blankets and allowed to move about in an open-front shed and corral, except during rain or predicted rain when they were confined to the shed.

Twenty other sheep were conventionally sheared on March 25 and housed similarly. Though the temperature range was extreme (18° to 72° F.), no ill effects were evident in either group of sheep.

A third group was dosed with CPA to study wool loss when the sheep were not defleeced. These sheep began to lose their wool 17 days later. Shortly after the sheep lost their wool, the temperature fell to near freezing with no ill effects on the animals.

This third group was redosed with CPA about 5 months later. Again, no ill effects either on sheep or the new fleece were observed. And, though the sheep's skin became red from exposure to the sun, the animals were not seriously sunburned.

Tests on the chemically removed wool were made by fiber technologist Mary E. Hourihan. Mrs. Hourihan found that chemically removed fleeces did not have the second cuts found in conventionally sheared fleeces. This means slightly higher-quality wool—a possible advantage to the producer. Staple length of the chemically removed wool was longer, since the treated sheep were defleeced to the skin while some wool is left on conventionally sheared sheep.

In still another test, neither the ewes nor their lambs were affected when four pregnant ewes were treated with CPA before lambing. Ewes were treated 19, 27, 56, and 60 days before lambing, and wool was removed 21 days after dosage to provide a short coat of new wool growth.

The chemical did not affect wool growth of the lambs. Nor did CPA affect the lambs when they were treated with 15 to 20 mg CPA per kg of body weight several months after they were born.

Use of CPA is experimental and has not been approved by the Food and Drug Administration as a defleecing agent. ■

Test identifies soybean seed variety

A NEW CHEMICAL TEST has been developed to distinguish between seeds of certain Northern soybean varieties.

Ultimately, a battery of chemical tests and visual observations could be used to identify individual varieties of soybeans and other crop seeds. Farmers, consumers, seedsmen, and geneticists could thereby determine for certain varieties that the seed label was accurate.

The new test, developed at Beltsville, Md., by botanist Arnold L. Larsen and technician William C. Benson, distinguishes seed of three soybean varieties from seed of 38 other Northern varieties by employing electrophoresis to separate seed enzymes. In this process, a seed extract is placed on an acrylamide gel. Isoenzymes, which are different molecular forms of the same enzyme, move through the gel at different rates dictated by their molecular sizes and electrical charges. Dr. Larsen found that about 2 hours of electrophoresis is required for the isoenzymes to separate from each other and to occupy sites in the gel at different locations from their common starting point.

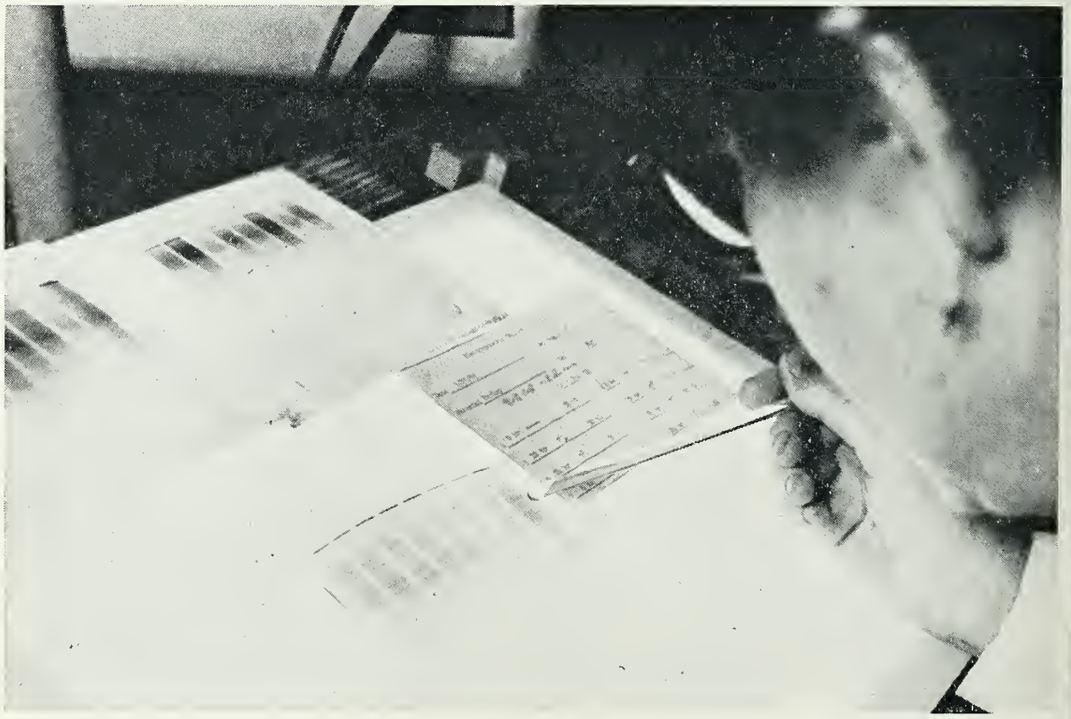
Dr. Larsen and Mr. Benson extracted enzymes, called INT-oxidases, from dry soybean seeds of each variety. These enzymes contained several isoenzymes. The final position of the various isoenzymes on the gel represented a sort of "chemical fingerprint," which was still invisible at this point in the test.

To develop a visible record, Dr. Larsen immersed the gel in a detection reagent containing a colorless salt, iodonitro-tetrazolium-violet and other constituents. Chemical reactions among the reagent components dyed the gel red except at locations containing the INT-oxidase enzymes, thereby leaving clear "fingerprint" bands against a red background.

Blackhawk, Grant, and Merit varieties produced two bands. A second group of 20 varieties produced four bands. A third group of 19 varieties produced the same four bands, but when the gel was exposed to another reagent a fifth band appeared, which was created by a different enzyme, a peroxidase.

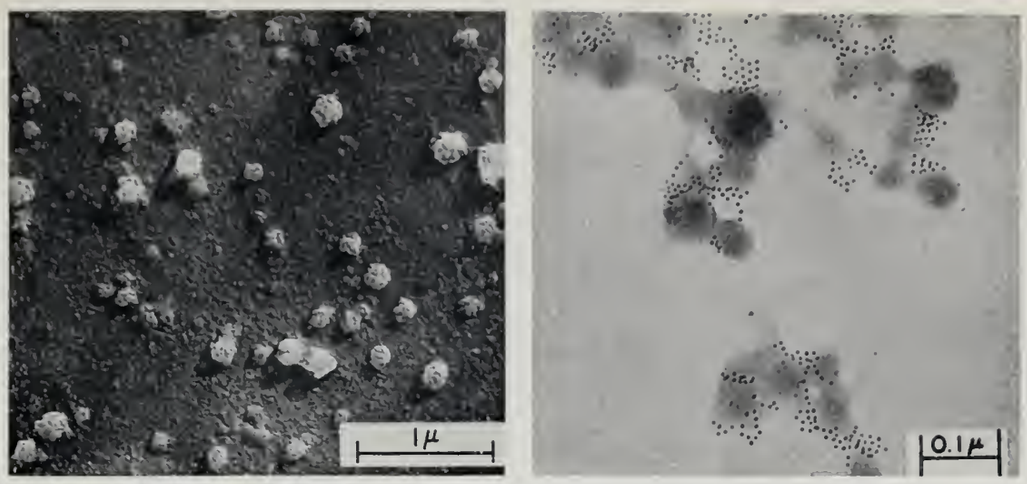
At least 30 enzymes can be divided into different isoenzymes. Many hundred enzymes probably exist simultaneously in a single seed, providing potential for a considerably more refined and faster test of varietal purity in seed lots than can be determined by present tests, which call for planting the seed and identifying the growing plant. Moreover, the banding pattern of the isoenzymes would be less subject to environmental influences than plant appearance.

Scientists are looking for more specific variations in isoenzyme composition of different enzymes to obtain useful markers to distinguish a greater number of individual varieties. Although such a degree of refinement remains to be obtained, Dr. Larsen's experiments represent a major step in that direction. ■



Gels are examined on a light table to identify the different isoenzymes in a soybean seed extract. The isoenzymes appear as the grey bands on the gel (970X869–9).

Mapping milk's casein



Electron micrograph of skim milk shows large micelles (PN–1908). In right micrograph, the dark spots are ferritin attached to kappa antibodies (PN–1909).

WHEN WE THINK of capsules of concentrated nourishment as the meals of the future, we ought to remember the cow. She packs so much nutrition into her milk that it contains almost 13 percent solids.

Yet we don't eat milk, we drink it. What keeps milk liquid is the fact that its fats and proteins are highly concentrated in tiny packages suspended in the fluid. The concentrations of fat are called globules and those of protein are called micelles.

The micelles are of particular interest to dairy scientists because they contain casein, which keeps milk stable. The main types of casein are known technically as alpha$_s$-, beta-, and kappa-casein. Kappa keeps the micelles intact. Without kappa-casein, alpha$_s$- and beta-casein will not remain in suspension, and milk is no longer a stable fluid. In storage, for instance, concentrated milk sometimes turns to a gel. That's because something has happened to the kappa-casein. And milk is curdled in making cheese by adding rennin, an enzyme that specifically breaks down kappa.

Since kappa is so critical to milk stability, biochemist Richard M. Parry, Jr., and electron microscopist Robert J. Carroll, at the ARS Eastern utilization research laboratory, Philadelphia, Pa., are interested in locating it precisely in the tiny casein micelle.

Their findings are challenging the theory that the kappa is arranged around the outside of the micelle like a coat, with the other components inside.

In studies of the skim milk micelles under electron microscope, Mr. Carroll saw irregularly shaped spheres against a background of far smaller particles. Then, under a much higher magnification, he viewed purified kappa-casein molecules, and these appeared strikingly similar to the background particles, suggesting that some of the particles could be kappa.

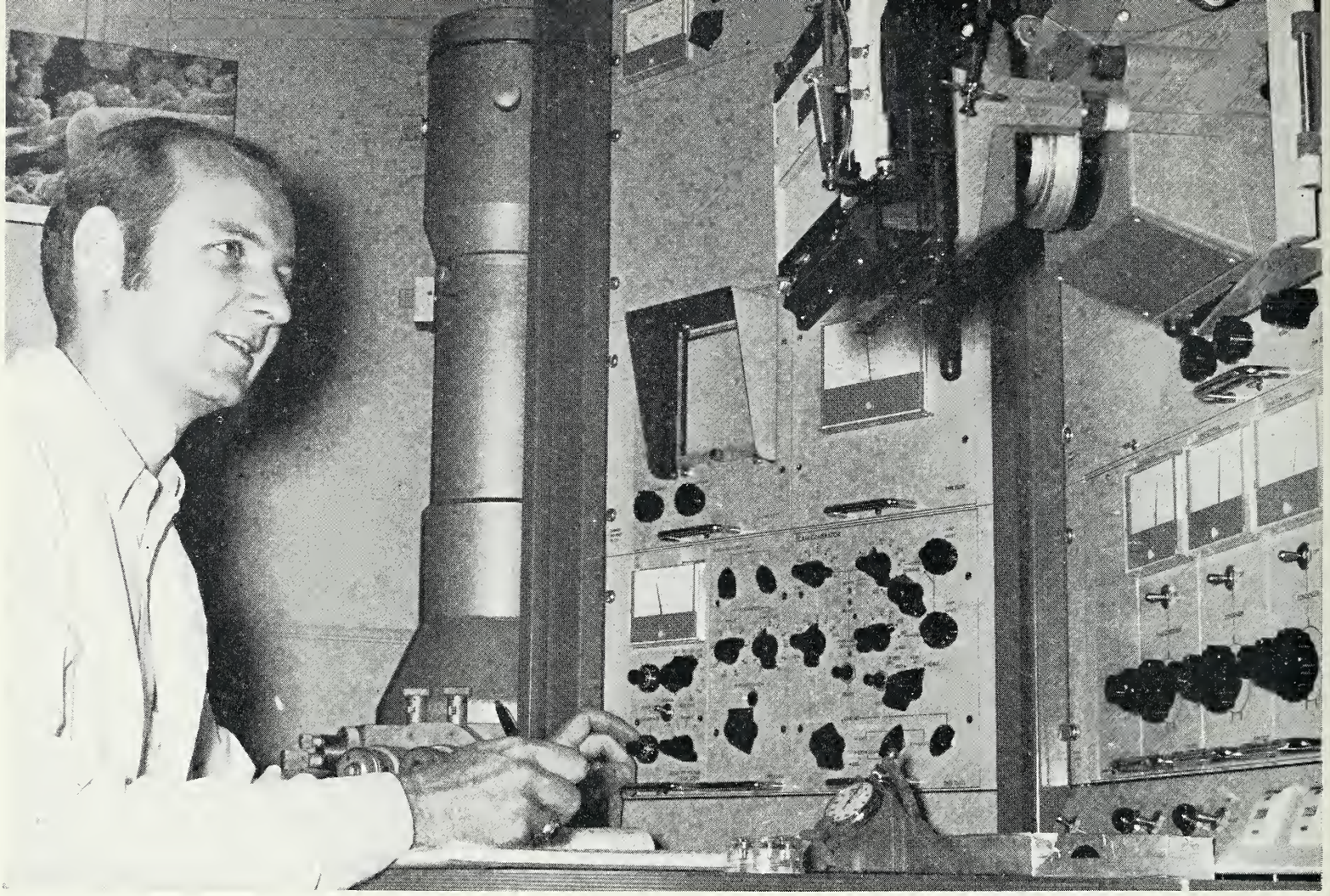
For a more positive identification of this intermicellar material, the scientists obtained antibodies to kappa from the blood serum of a previously sensitized rabbit. They labeled the antibody with the iron compound ferritin and added it to skim milk. The antibody attached itself to the kappa and could be seen clearly when the scientists looked at the micelles of the skim milk under the electron microscope. As they had suspected, some of the kappa was not *on* the surface of the micelles, but concentrated *between* them.

But apparently not all the kappa is located between the micelles. To exert the stabilizing influence it does on the micelles, at least some must be imbedded within them. To find out how much is inside. Dr. Parry repeatedly centrifuged the micelles of skim milk, each time obtaining the micelles in the form of a pellet, then redispersed the pellet in a buffer solution that he used for the next cycle.

On the first centrifuging, the micelles lost a little kappa, but after this, their kappa content remained fairly constant. Successive experiments with rennin, performed on the redispersed micelle pellets after each centrifuging, showed that clotting took longer each time, indicating progressive removal of the intermicellar kappa. After the sixth centrifuging, no clotting took place.

These tests led Dr. Parry and Mr. Carroll to propose a new model for casein, with 70 percent of the kappa in the interior of the micelles, surrounded by alpha$_s$- and beta-casein and calcium phosphate. This protected kappa would account for the relatively constant kappa content of the micelle pellets in the centrifuging experiments. The remaining 30 percent would be the intermicellar kappa which was identified in the electron microscope by the ferritin-labeled kappa antibody and which is responsible for rennin clotting. Not being bound within the micelles, this kappa was progressively removed by the centrifugings.

Like other theories, this proposed model is subject to further investigation. But it fits the experimental evidence obtained thus far and may be an important clue to the eventual development of increased stability in milk and milk products. ■



Scanning electron microscope

THE scanning electron microscope, a relative newcomer to the field of microscopy, is expected to play a large role in the future of cotton textiles.

To meet the demand for easy-care cottons, chemical treatments were developed to produce durable-press and easy-care fabrics. But these treatments also create problems. For example, durable-press cottons are not as resistant to abrasion as untreated cottons.

In the microscopy laboratory, attempts have been made to determine precisely when abrasion occurs in the life of a fabric. The attempts proved extremely difficult and the results not very reliable.

With the light microscope, for example, observing individual fiber damage within a fabric is virtually impossible. The surface of the sample can not be properly illuminated, and only a small portion of the surface can be brought into focus because of the very narrow depth of field.

The transmission electron microscope does yield some information on fiber damage, but only single fibers can be observed and again depth of field is a limiting factor. Interpretation of the electron micrographs is also a problem.

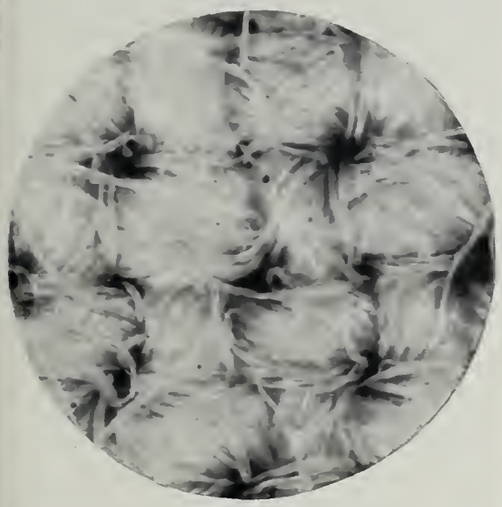
In contrast, the scanning electron microscope (SEM) offers a means of direct, detailed observation of fabric surfaces at high magnification and with great depth of field.

The SEM is currently employed at the ARS Southern utilization research laboratory to compare surface appearances of chemically modified and unmodified, and abraded and unabraded fabrics to gain a better understanding of the phenomenon of wear abrasion.

Although these studies are still in the early stages, ARS chemist Wilton R. Goynes, Jr., has learned that untreated printcloth ruptured after 2,000 cycles in a machine designed to measure flex abrasion resistance. Examination of the ruptured fabric with the SEM allowed critical comparison with the unabraded fabric. Photographs made during the examination clearly showed how the individual fibers were splintered and broken. Much the same thing occurs in durable-press cotton fabrics, but after fewer abrasion cycles.

By contrast, an abrasion-resistant printcloth produced by irradiation-induced chemical modification sus-

Left: Mr. Goynes adjusts the SEM. This instrument became commercially available in the United States in 1965 and, because it facilitates viewing of opaque surfaces, its use has grown tremendously. Other electron microscopes usually require thin, translucent sections (PN–1919).
Below: Surface of cotton fabric viewed through an optical microscope at 100X magnification. Note the lack of sharpness and clarity (PN–1921).



a good look at cotton fabrics

tained an entirely different type of damage. After 24,000 abrading cycles no rupture occurred in the experimental fabric, but the individual fibers appeared flattened, smoothed, and even sheared. Instead of splintering as the fibers in the control fabric and the durable-press fabric did, the fibers seemed to have fused, possibly preventing damage deep within the fabric.

Whether the solution to the abrasion problem rests in this particular approach to chemically treated cottons is presently unproved. What is certain, however, is that the SEM is destined to help guide scientists in solving the abrasion problem and in developing other improvements in chemical treatments for cotton textiles. ■

A piece of durable-press cotton fabric seen through the SEM under three magnifications. At left is the fabric before abrasion; right, after 90 abrasion cycles (PN–1922).

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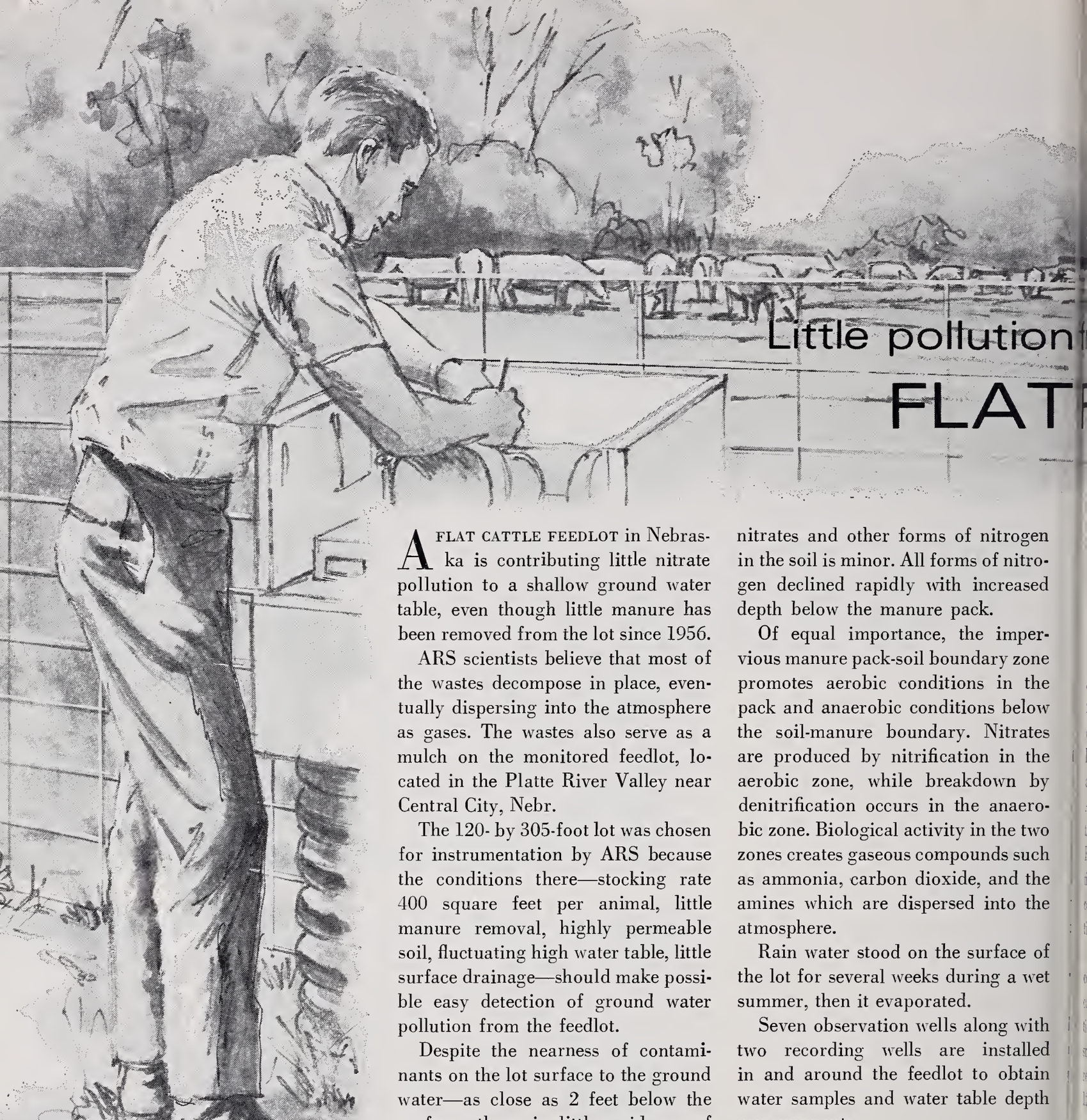


Little pollution f

FLAT

A FLAT CATTLE FEEDLOT in Nebraska is contributing little nitrate pollution to a shallow ground water table, even though little manure has been removed from the lot since 1956.

ARS scientists believe that most of the wastes decompose in place, eventually dispersing into the atmosphere as gases. The wastes also serve as a mulch on the monitored feedlot, located in the Platte River Valley near Central City, Nebr.

The 120- by 305-foot lot was chosen for instrumentation by ARS because the conditions there—stocking rate 400 square feet per animal, little manure removal, highly permeable soil, fluctuating high water table, little surface drainage—should make possible easy detection of ground water pollution from the feedlot.

Despite the nearness of contaminants on the lot surface to the ground water—as close as 2 feet below the surface—there is little evidence of pollution in the aquifer. Observations and measurements indicate that the manure pack (near 1 foot thick) and the soil and manure form a common boundary (interface) that effectively bars water movement.

Analysis of soil core samples showed that downward movement of nitrates and other forms of nitrogen in the soil is minor. All forms of nitrogen declined rapidly with increased depth below the manure pack.

Of equal importance, the impervious manure pack-soil boundary zone promotes aerobic conditions in the pack and anaerobic conditions below the soil-manure boundary. Nitrates are produced by nitrification in the aerobic zone, while breakdown by denitrification occurs in the anaerobic zone. Biological activity in the two zones creates gaseous compounds such as ammonia, carbon dioxide, and the amines which are dispersed into the atmosphere.

Rain water stood on the surface of the lot for several weeks during a wet summer, then it evaporated.

Seven observation wells along with two recording wells are installed in and around the feedlot to obtain water samples and water table depth measurements.

Water samples were taken periodically from wells next to the feedlot and analyzed. Only twice during 2½ years of sampling did nitrate-nitrogen readings exceed 10 parts per million. Dates of these samples coincided with irrigation pumping that could have brought nitrate-nitrogen into the pro-

file under the feedlot from adjacent fields. The Public Health Service has set 10 ppm as the maximum desirable limit for nitrate-nitrogen in drinking water.

ARS soil scientist Lloyd N. Mielke, agricultural engineers Norris P. Swanson and Jeffrey C. Lorimer, and microbiologists Thomas M. McCalla, Lloyd F. Elliott, and James R. Ellis, are cooperating with the Nebraska Agricultural Experiment Station in the studies, supported in part by the Federal Water Quality Administration. They estimate that 20 to 40 percent of Nebraska cattle feeding operations are on flat, permeable soil.

Their measurements indicate that considerable amounts of solid wastes can be removed simply by decomposition on the lot. Even though relatively small amounts of manure have been removed from the lot since 1956 only 12 to 15 inches of organic matter has accumulated on this flat feedlot.

These field observations are supported by Dr. McCalla's laboratory studies in which as much as 90 percent of the nitrogen and 50 percent of the solid wastes can be decomposed in 4 months of incubation under spring and summer simulated climatic conditions. ■

Caissons aid feedlot research

To get undisturbed soil atmosphere and soil solution samples beneath the flat feedlot, ARS scientists at Lincoln sunk two cylindrical steel caissons in the lot.

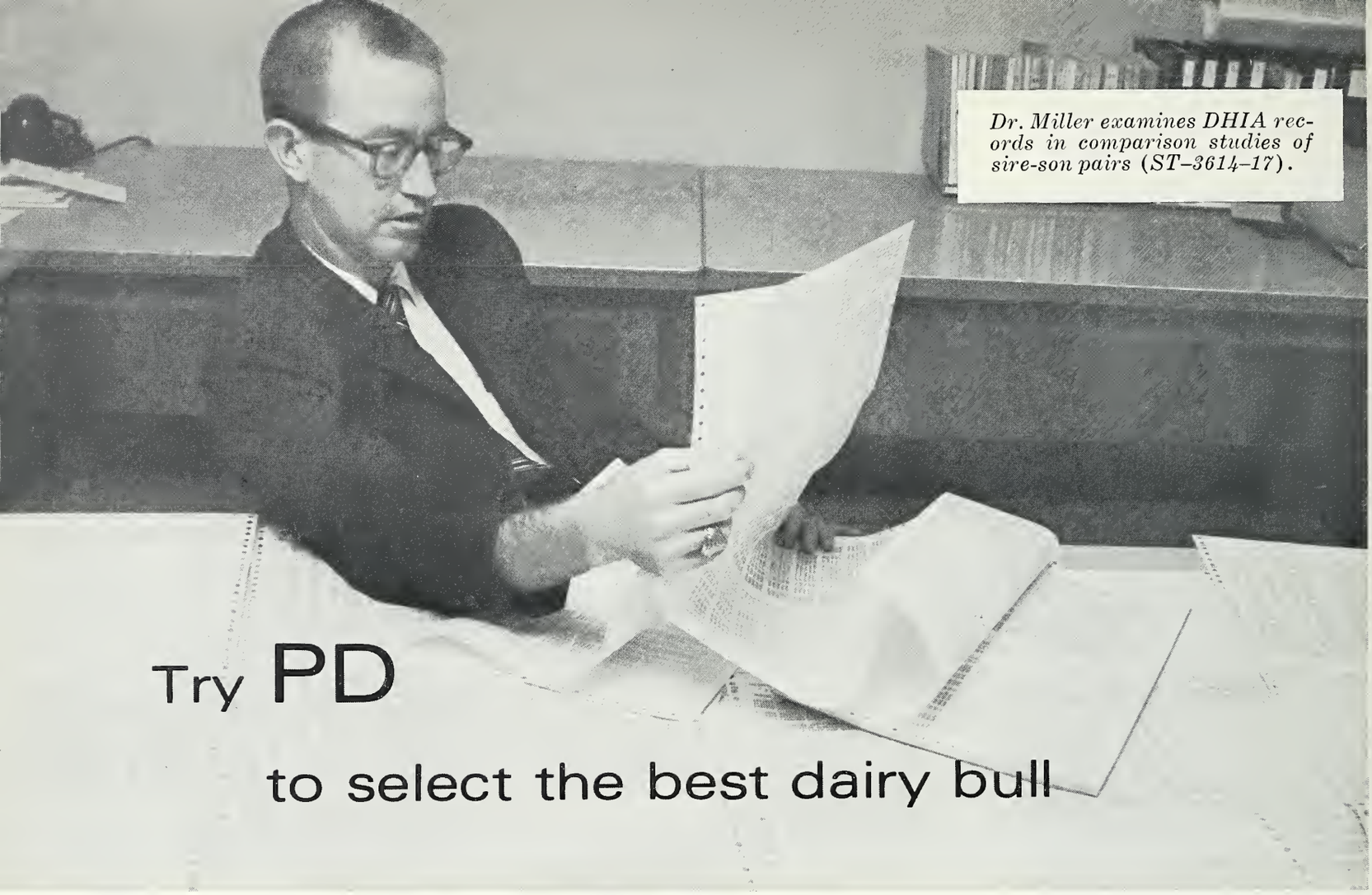
The caissons—3½ feet in diameter and 7½ feet deep—were marked off in quadrants on the inside surface, and holes fitted with pipe plugs were located in a spiral pattern from top to bottom in all four quadrants so that no hole was directly beneath the hole above. With the plugs removed, suction cups are placed in the soil profile, and soil solution samples can be obtained for nitrogen, phosphorus, and organic matter analysis.

Smaller holes accommodate gas sample tubes inserted horizontally into the soil profile.

A small bottle containing helium is connected to each gas sampler with a neoprene tube, and the contents allowed to equilibrate with the soil atmosphere. The bottles are filled with helium so the sample bottles will not introduce oxygen to the soil profile. Samples from the bottles are analyzed by gas chromatography to detect carbon dioxide (CO_2), oxygen (O_2), nitrogen (N_2), and methane (CH_4).

Under the feedlot, CH_4 and CO_2 concentrations ranged from 0 to 55 percent and 0 to 40 percent, respectively. This compared with 0 to 1.6 percent CO_2 and no CH_4 in the soil atmosphere outside the feedlot where another caisson was located in an adjacent cornfield. Oxygen concentrations in the feedlot profile ranged from 0 to 20 percent, while the nonfeedlot profile remained at 19 to 20 percent. High CH_4 and CO_2 levels were accompanied by low O_2 and N_2 concentrations. Methane and high levels of CO_2 were detected only when the feedlot surface was wet. This research is supported in part by the Federal Water Quality Administration, Department of the Interior. ■

Dr. Lloyd F. Elliott collects soil solution and soil gas samples. (*Photo by Don Ringler,* Omaha World-Herald.)



Dr. Miller examines DHIA records in comparison studies of sire-son pairs (ST–3614–17).

Try PD to select the best dairy bull

IN THEORY, genetic improvement of milk production in dairy cattle could be about 2 percent annually. But in practice, improvement has been much less than this potential.

A major reason for the inhibition is that sires of future herd bulls are not regularly selected on ability as herd improvers, conclude ARS dairy scientists Benjamin T. McDaniel, Frank N. Dickinson, Robert H. Miller, and Victor H. Lytton at Beltsville, Md. They say choosing the best bulls to father the next generation of bulls is the greatest single source of genetic improvement in dairy cattle.

The investigators checked the records on almost 19,000 sire-son pairs—Ayrshire, Guernsey, Holstein, Jersey, and Brown Swiss—and compared Predicted Differences (PD) of each pair.

The PD is an estimate of a bull's genetic merit: how much the milk and fat production of his daughters will deviate from the breed average. A "plus" PD indicates breed improvement; "minus" PD means daughters that will produce below herdmates in breed average herds.

Average PD for milk yield of fathers of bulls in only one breed, Jersey, was plus; the average sire in other breeds studied would actually decrease production in a breed-average herd.

It's up to the dairyman to pick top bulls, but this isn't hard to do, the scientists explain. Dairy Herd Improvement sire summaries, updated every 4 months and published every year, include the PD's for milk and fat. They are available from State and county extension offices. Breed associations and AI studs also help distribute the information.

A few minutes with these summaries can be some of the most profitable time a farmer spends. For example, the researchers figure each 100-pound increase in the sire's PD for milk is worth $3.22 in income over feed per daughter in her first lactation. This figure is based on U.S. average feed prices and $5 per hundredweight for milk.

The average PD for milk among Holstein bulls in the sire-son study was minus 30. If dairymen had chosen some of the bulls with a plus 500-pound milk PD, they could have increased income over feed by several hundred dollars in a 50-cow herd.

Selecting sires of herd bulls based on PD pays off in the same way, since high PD bulls sire sons with high PD's. And the scientists suggest that using bulls with PD's for milk of 500 pounds or better to father future bulls is a realistic standard for most breeds.

Many dairymen pick herd bulls on the dam's production record. While this is a step above random choice, selection pressure on sires is the best route to bulls that will generate greater production and income. ■

Vaccine for Newcastle Disease

A HIGHLY EFFECTIVE killed-virus vaccine has been developed for Newcastle disease of poultry.

About 95 percent of the chicks hatched in this country are vaccinated against Newcastle disease by placing a live-virus vaccine in the drinking water. While this method is fast, easy, and inexpensive, poultrymen are perpetuating the agent of this disease in their flocks.

Standard inactivated vaccines now available are generally ineffective on passively immune chicks—those chicks which gain some immunity from the vaccinated hen. Also, most inactivated vaccines on the market are recommended for chicks past 2 to 3 weeks old—a considerable delay in waiting to vaccinate.

In tests at the National Animal Disease Laboratory, Ames, Iowa, ARS veterinarians William A. Boney, Jr., and Henry D. Stone found that their killed-virus vaccine was effective for both immune and susceptible chicks. Moreover, it can be used on day-old chicks at the hatchery or farm.

Alum precipitation of the virus is the key to the vaccine's success. Alum had not been used with viruses before because in humans, it causes an objectionable reaction at the site of injection—a condition found not to exist in chicks.

A drawback of the inactivated vaccine is the mode of vaccination: it involves injection rather than the more convenient administration in the drinking water.

Before the advent of vaccines, the highly contagious Newcastle disease virus sometimes killed 90 to 100 percent of the chicks in a flock, although the average loss was 30 to 40 percent. Chicks that survived an outbreak were retarded in growth and lower in feed efficiency. In the laying flock, hens produced fewer and lower-quality eggs, although in some cases, 80 percent of the layers were killed by the virus. Other birds, animals, and occasionally man may be infected with the Newcastle disease virus.

The new vaccine could greatly benefit countries where live-virus vaccines are not permitted. And it could benefit the U.S. poultry industry should a Newcastle disease eradication program be started. An inactivated vaccine which eliminates the chance of spreading the disease would be needed to replace live-virus vaccines now in use. ■

Hide defect inherited?

A DEFECT in the hides of some cattle which weakens the hide, making it unfit for many manufacturing processes, may be inherited.

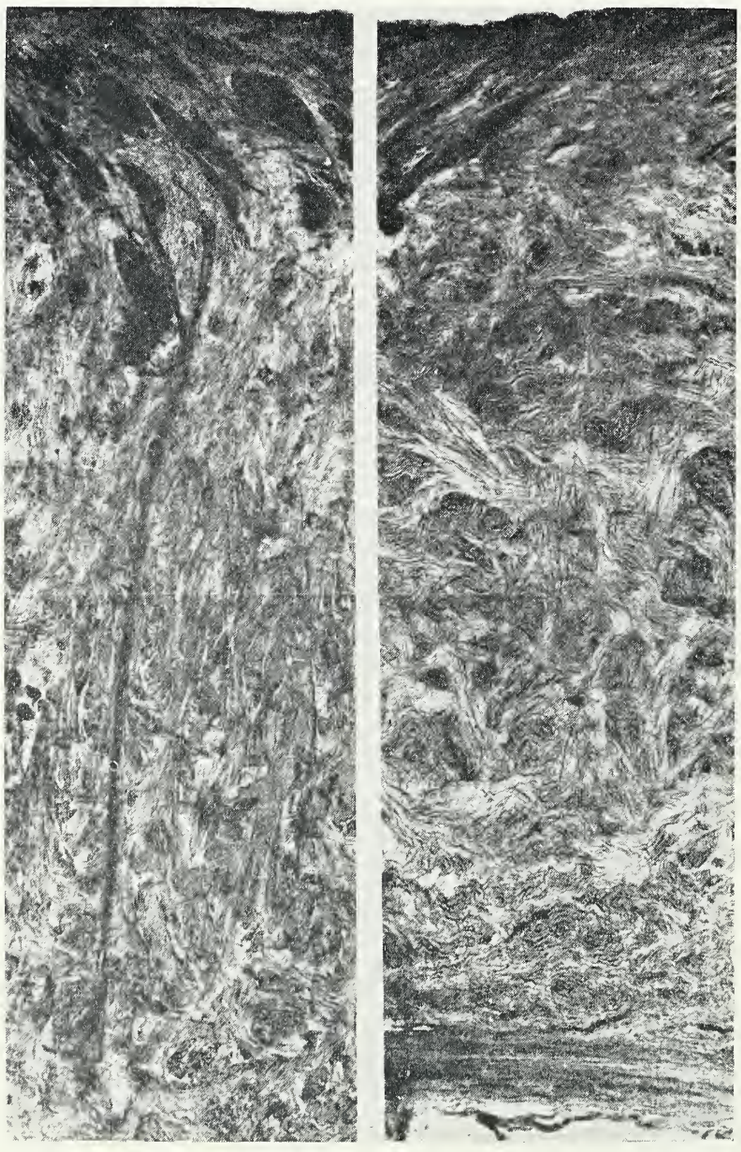
Called vertical fiber defect, it causes the leather grain to crack open during the manufacturing of shoe uppers and other products which require strong leather. Unlike a normal hide in which the tissue fibers are randomly interwoven making the leather strong and durable, the defective hide has parallel fibers which lie perpendicular to the surface (AGR. RES. July 1965, p. 8). Parallel fibers can easily be pulled apart, tearing the leather.

If this defect were easy to spot, the weak hides could be sorted out before tanning—but this is not the case. The tanner must wait until after the hide is processed to uncover the defect. Losses to the industry from weak hides amount to $5 to $10 million annually.

New evidence that the defect may be inherited was found by ARS scientists Alfred L. Everett and Mary V. Hannigan working at the Eastern utilization research laboratory, Philadelphia, Pa. They studied 30 pairs of identical and fraternal twin Hereford and Holstein yearling heifers. The cattle are part of a long-term nutritional study on the effects of feeding high- and low-energy rations.

Mr. Everett and Miss Hannigan microscopically examined biopsy skin samples from the rumps of the calves. They found three pairs of identical and one of a pair of fraternal twins that exhibited the defect. All the affected animals were Herefords, the breed most susceptible to this weakness. Dairy cattle have not yet been found with this defect.

Using biopsy skin samples to study the hide of the living animal is a novel approach to leather research, permitting more extensive investigation of biological factors involved. This approach may clarify the effects of age and nutrition on genetic relationships to hide defects and leather quality. ■



Cross sections of two salt-cured hides. ***Left:*** *A defective hide with fibers arranged nearly perpendicular to the surface of the hide.* ***Right:*** *A normal hide showing the interwoven fibers randomly arranged (PN–1920).*

Finding defective hides in identical twins presents additional evidence to support inheritance as the factor determining the weakness. A previous study of hides from steers of known parentage indicated this defect was concentrated in certain sire lines.

As a sidelight of this study, the scientists also discovered that heifers on the high-energy ration could easily be distinguished from those on the low-energy ration by the amount of fat in the hide tissue samples viewed under the microscope. Tissues of cattle on the high-energy ration contained much more fat. Heavy amounts of fat cause greasy hides which often make poor leather, but at present, there is little information on the relationship of feeding to fatty hides. In the future, however, a steer's heredity and diet may be of prime importance to the tanner.

Herbicide technique cleans canals of

Reed Canarygrass

REED CANARYGRASS may be on the way out as a major weed problem in the Pacific Northwest. An experimental technique for chemical treatment has given 95 percent or better control of this weed in work spanning 3 years.

In some parts of the nation, reed canarygrass is a desirable forage crop. However, when it grows along ditchbanks of canals serving an estimated 3 million acres of irrigated land in Montana, Wyoming, Utah, Oregon, and Washington, it ranks with Canada thistle as one of the region's two most damaging ditchbank weeds.

Growing rapidly to as high as 7 feet, reed canarygrass topples into the water channels and roots at the nodes. These rootlets collect silt. Unchecked, the canarygrass slows water flow by as much as 70 percent, causes flooding, and eventually can overgrow entire canals. The outgrowth harbors rodents such as muskrat, beaver, and gophers which burrow and sometimes cause breaks in canal banks.

The current control methods are more expensive and less effective than the new system. Draglining costs between $1,000 and $1,825 per mile and must be repeated every 5 to 7 years. Regular mowing only slows growth and eventually must be followed with draglining or chemical treatments. Present chemical treatments are: (1) a foliar spray of amitrol-ammonium-thiocyanate applied at 4 to 6 pounds per acre each May and August at a cost of about $70 a mile, plus labor and equipment, or (2) applications of dalapon (2,2-dichloropropionic acid) at 15 to 25 lb/a twice a year, which costs about $80 a mile in addition to labor and equipment.

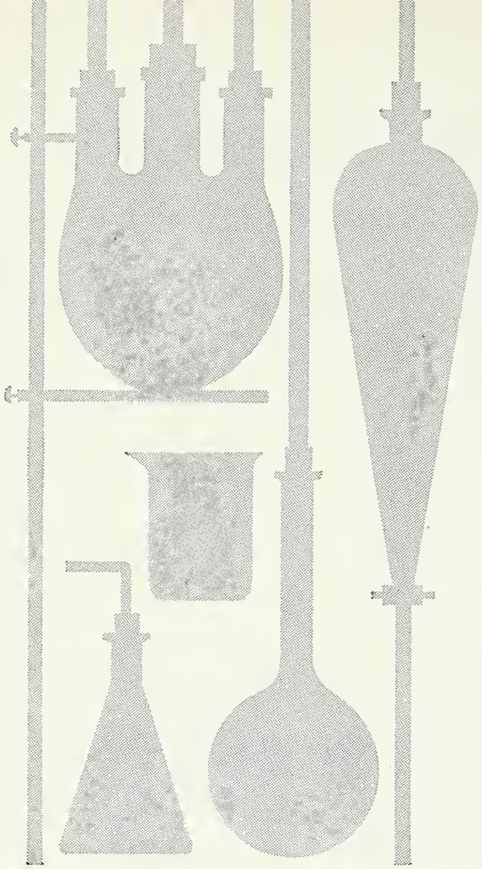
ARS plant physiologist Richard D. Comes at Prosser, Wash., developed the new system. He applied dalapon or TCA (trichloroacetic acid) at 20 lb/a in November when the plant was dormant and the canal free of water. The next summer, either dalapon at 20 lb/a or amitrol-T (3-amino-*s*-triazole+ammonium thiocynate) at 4 lb/a was applied. This was followed in November and each year thereafter with dalapon or TCA at 20 lb/a.

This system safely and effectively controlled the canarygrass at about $40 a mile with TCA plus amitrol-T, or about $80 with dalapon. Since the first year requires the most chemicals and labor, the costs in succeeding years would be considerably lower—about $14 per mile plus equipment and labor costs.

Broadleaf weeds such as mustard and wild lettuce, as well as Canada thistle that tended to grow with reduced competition from the canarygrass, were controlled separately. After the first step in the canarygrass treatment, 2,4-D at 2 lb/a was applied the following spring and every year thereafter.

The chemicals in Mr. Comes' system do not appear to persist in the soil or water for long periods of time. When areas treated in November were seeded the following March to redtop, a susceptible plant, the germination was satisfactory. Analysis of water flowing through the experimentally-treated section indicated that the level of TCA residue in the water decreased rapidly with no detectable residues present in the water 24 hours after the water first reached the treated section.

The chemicals applied in the new system are not registered for this use by the USDA. ■



AGRISEARCH NOTES

1970 Yearbook—Contours of Change

The forces of change which constantly and relentlessly reshape rural America are closely examined in the 1970 Yearbook of Agriculture.

Contours of Change, the preface notes, is "a situation report on that often neglected third of all Americans" who live beyond the city line. It is also a report about agriculture, a complex activity often taken for granted even though it is the wellspring of our food, fiber, and timber. The scope of the Yearbook, which contains 59 chapters and 408 pages, is reflected in such chapter titles as "Are They Making a Living Down on the Farm"—"Tomorrow's Vision Saves Many of Today's Rural Communities"—"Systems Come, Traditions Go"—"Enough Land for Tomorrow"—"New Technology: Rose and Thorn"—and "A Single Chariot With 2 Horses: The Population and Food Race." Included are hundreds of photos, many in color.

In his foreword, Secretary of Agriculture Clifford M. Hardin says the Yearbook points to "the task that lies ahead in creating a new, promising environment of opportunity—economic, educational, cultural, recreational—as America continues to grow." The Secretary also observes that city dwellers have an equal interest with rural people in the future economic development of rural America "since a sound pattern of national growth can alleviate many of today's urban problems."

Copies of *Contours of Change*, the Yearbook of Agriculture, may be purchased for $3.50 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Members of Congress have a limited supply for free public distribution.

Planting Seed Piece Sugarcane

Cane mechanically planted as short seed pieces in the summer can yield as well as cane planted conventionally in the fall.

This is the conclusion of ARS plant physiologist Gerd T. A. Benda and ARS agronomist Richard D. Breaux, Houma, La., in yield studies of four commercial sugarcane varieties. Cane yields from mechanically planted short seed pieces were not significantly higher than the usual whole stalk plantings. However, sucrose per ton of cane was slightly but significantly higher, resulting in almost 600 pounds more sugar per acre than from the conventionally planted cane.

The short seed pieces, containing one to three buds, were prepared from freshly harvested whole stalks. They were treated with a fungicide and neither end was waxed before planting on August 7. The whole-stalk cane was planted in the conventional manner September 26. All cane was harvested November 19 the following year.

Along with higher sugar yields, the short seed piece study also points to the eventual possibility of mechanized planting with better planting rates for expensive seed cane.

*See Amer. J. Vet. Res. 31(2): 253-258, 1970.

Johne's Disease Bacillus Isolated

The bacillus that causes Johne's disease in cattle has been isolated from all the genital organs, except the testes, of six diseased bulls.

This finding, by ARS veterinarians Aubrey B. Larsen* and Kenneth E. Kopecky at the National Animal Disease Laboratory, Ames, Iowa, confirmed earlier investigations, which found this bacillus, *Mycobacterium paratuberculosis*, in the intestine, mesenteric lymph node, and semen of bulls. The reproductive tracts of cows and fetuses may also harbor this bacillus.

However, there is no proof that a cow or fetus can be infected with *M. paratuberculosis* through contaminated semen. Fortunately, present culturing techniques can detect the bacillus in cattle before the animal shows clinical signs of the disease.

Johne's disease (paratuberculosis) can cause serious losses to cattlemen. Infected animals lose weight and milk flow decreases or even ceases. The hair coat thins, skin dries, and the animal suffers from diarrhea. Animals may be infected for years without showing any symptoms of the disease. Slaughtering infected cattle is one procedure used for eliminating the disease from a herd.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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